

Some Notes on the Life-History of *Margaritifera panasesæ*.

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MARGARITIFERA PANASESÆ is a small Mother-of-Pearl Oyster, of no commercial value or use. It is found in various parts of the Pacific, more especially in New Guinea waters. The species was identified in 1901 as Gould's *Avicula maculata* by Dr. H. L. Jameson, and appears in his classification of Mother-of-Pearl Oysters under the above name (see Proceedings Zool. Soc. Lond., April 26, 1901).

In appearance the shell is not unlike several species of Lingahs, although smaller and less convex. Its antero-posterior measurement seldom exceeds $1\frac{1}{2}$ inches, the largest specimen I have being $2\frac{1}{2}$ inches. In markings and colour there is much variation. The ground-colour may be either white, black, dark green, or purple. The shell may be either uniformly white or uniformly dark. When the ground-colour is white, markings generally occur as black, purple, or dark green irregularly placed blotches or regular radii. The nacre, which is generally tinged yellow, is transparent, except in old shells, and possesses a reddish-green sheen.

My observations were made consequent on the discovery of an enormous natural deposition of the spat of this species in a secondary lagoon of several acres in extent, which encloses one of the central islands (Itamarina) of the Conflict Group Atoll, British New Guinea. During the months of February and March I have estimated, on several occasions, that the deposit amounted to fifty or so young shells per square foot of suitable ground. There was very little evidence of such a deposit a few days after it had been noted, and by August there was little or no trace of any shells having survived. What Huxley said of the precariousness of the early existence of the edible oyster is equally applicable to this species:—"The minute larvæ are probably swallowed by everything which has a mouth large enough to admit them; and as soon as the young oysters have become sedentary, they are eaten by everything which has jaws strong enough to crush them."

Many shells of this species seem to overestimate the importance

of a protected position, and only survive a few months, the secluded spots they have anchored in proving too small for the growing shells. A large number are smothered in silt or seaweed; and amongst the enemies of those that manage to secure themselves to a support may be mentioned the numerous species of fish, crabs, starfishes, &c. A peculiarly insidious enemy is found in the person of a small whelk, which, during the first few months of growth, pierces a neat hole in the thin shell, producing, apparently, a paralytic effect on the adductor muscle, with the result that the bivalve loses the power of closing its shell against the unwelcome visitors. Quantities of young dead pearl-shell are washed up on to the beaches with every returning tide, and on a large proportion of these is found this small perforation, and, curiously enough, in the majority of cases this is situate in the neighbourhood of the attachment of the adductor muscle.

The species is dioecious, and the embryo is formed by the union of the sexual elements outside the shell. After a free-swimming stage of probably a few days' duration, a pair of shells is formed; and the embryo, as a result of its increased weight, sinks to the bottom and is washed into, and lodges in, the crevices between layers of seaweed or at the junction of the branches of dead coral and other places. At this stage the shells measure 1 mm. to $1\frac{1}{2}$ mm. in diameter, and in appearance are either pure white or else have a white ground with circumferential dark green or black blotches, forming a band either wholly or partly around the margin.

In many cases, where the situation is an exposed one, the young shell, after deposition, makes a tour of the neighbourhood in search of a cranny where it can hide itself from the detection of its enemies. For the purposes of locomotion, a modified foot is cautiously protruded from the region of the byssal cleft. It has the appearance of a muscular thread, and its maximum length is about equal to that of the hinge-margin. This organ, after describing circulatory movements and testing the ground in every direction, attaches its extremity in the direction decided on, and, by the contraction of its substance, draws the oyster after it, the latter resting with its flatter side (*i. e.* the right valve) below. Progress is necessarily slow; nevertheless, I have known spat under observation travel a foot or so during a few hours previous to anchorage.

At this stage, and in the majority of positions, the young shell runs the risk of being washed away, and its existence ended by being smothered in silt. To guard against such a contingency happening whilst the bivalve is unattached, a minute thread, similar in appearance to a strand from a spider's web, is during its progress paid out. This thread is strong enough to sustain the weight of the oyster, and by its aid it is enabled, if necessary, to regain its lost footing. I did not for some time suspect the existence of this thread, as it is invisible except under the closest observation. However, whilst I was noticing some movements of spat placed on a suspended slab of cement in a small aquarium, I found that the spat travelled to the edge of the slab and, in some cases, succeeded in reaching and anchoring itself on the under surface (away from the light) without mishap. Others, however, were not so fortunate, and on reaching the edge toppled over, but, to my surprise, did not fall to the bottom of the tank, but remained a fraction of an inch or so below the slab, suspended, as I then discovered, by means of the minute thread referred to above. To regain its position on the slab was then a comparatively easy matter for the oyster. I think it probable that the presence of these minute threads may explain the fact that these shells are so often found grouped together and even anchored on one another.

As soon as a suitable locality has been found, the shell secures itself by means of its byssus, an attachment which at first consists of a single strand, adhesion being effected by means of a disc-like expansion of its extremity. Other strands are fixed in all directions as the shell grows older, and the resultant bundle is the means of the oyster maintaining an upright and rigid position. The strands are so firmly attached to the anchorage that, if the oyster is forcibly torn away, the fracture occurs at the junction of the byssus and the oyster. Judging from the numbers of bundles observable on dead coral &c., it is probable that such a thing is of frequent occurrence under natural conditions. A new byssus is, however, always formed, the time taken for preliminary re-attachment being only an hour or so. Power of independent movement is, however, confined to shells of six months of age and under; and doubtless the possibility or the necessity of locomotion grows less and less as the shell grows older and its position more secure. This fact would be sufficient to account for the atrophy of the foot during

the latter part of the existence of this bivalve. On the other hand, the formation of new byssi is possible, and, if occasion demands it, always occurs in shells of almost any age.

Degeneration consequent on a more sessile existence is observable, in this species, in the atrophy of the modified foot during the latter part of the bivalve's existence. The presence of rudimentary hinge-teeth in this species is also worthy of notice.

I have been unable to observe any indications of independent movement in the spat, or young shell, of the New Guinea variety of the black-edged Mother-of-Pearl Oyster (*Margaritifera margaritifera*). As in *M. panasesæ*, its byssus is permanent and persists throughout life, being instrumental in keeping the oyster in an upright position. In the event of accident a new byssus is formed (almost at any age, as in *M. panasesæ*), provided that suitable anchoring material exists within reach. This species possesses no trace of hinge-teeth.

In the white- or golden-lipped Mother-of-Pearl Oyster (*Margaritifera maxima*), of commercial importance, no movement is reported as having been observed in the young shell or spat. A byssus is formed, but it is not a permanent one, and does not persist beyond the ninth month or so. After that age, and for its stability, the shell relies on its weight and lies, unattached in any way, on the bottom. This species also possesses no traces of hinge-teeth.

With these three types it is possible to form an interesting series illustrative of the modifications which have taken place within the subgenus *Margaritifera*. *M. panasesæ*, with its rudimentary hinge-teeth, permanent and renewable byssus, whose formation is preceded by locomotion by means of a modified foot, may be taken as a type possessing the most primitive characteristics. *M. margaritifera*, showing absence of hinge-teeth and foot, but presence of permanent and renewable byssus, may be taken as a more advanced type. *M. maxima*, with absence of hinge-teeth and foot and with only a temporary byssus, may be taken as a type representing the highest development among the Mother-of-Pearl Oysters. Further investigations in connection with intermediate forms would no doubt make the series more complete.